AI

and models of IA Inspired Nature

Naturalezahaconducidodesde

espectacularessimulaciones.

the
diseñándosedesdeentoncesun computa
tested.
bioinspirados
deinspiración
scientists
propiaNaturalezalaqueseconvierteenfue
aquelenelqueesla
engineers:
and
from
emprendieronotrocamino
eficaciayutilidad

computer? unasimulaciondeestosprocesosnoibaa provide

good ones

results

in

a

that

"bioinspiration"

dependent

somewhat

of

orientaciónyelusoquesehaga

dela

- Algorithms based in intelligence
- Redes Neuronales Artificiales,
- Algoritmos basados en Colonias de Hormigas,
- from Swarms,

learning models and approach inspired b

delivers

typical

electrical impulses along an axon fiber cleaving at thou

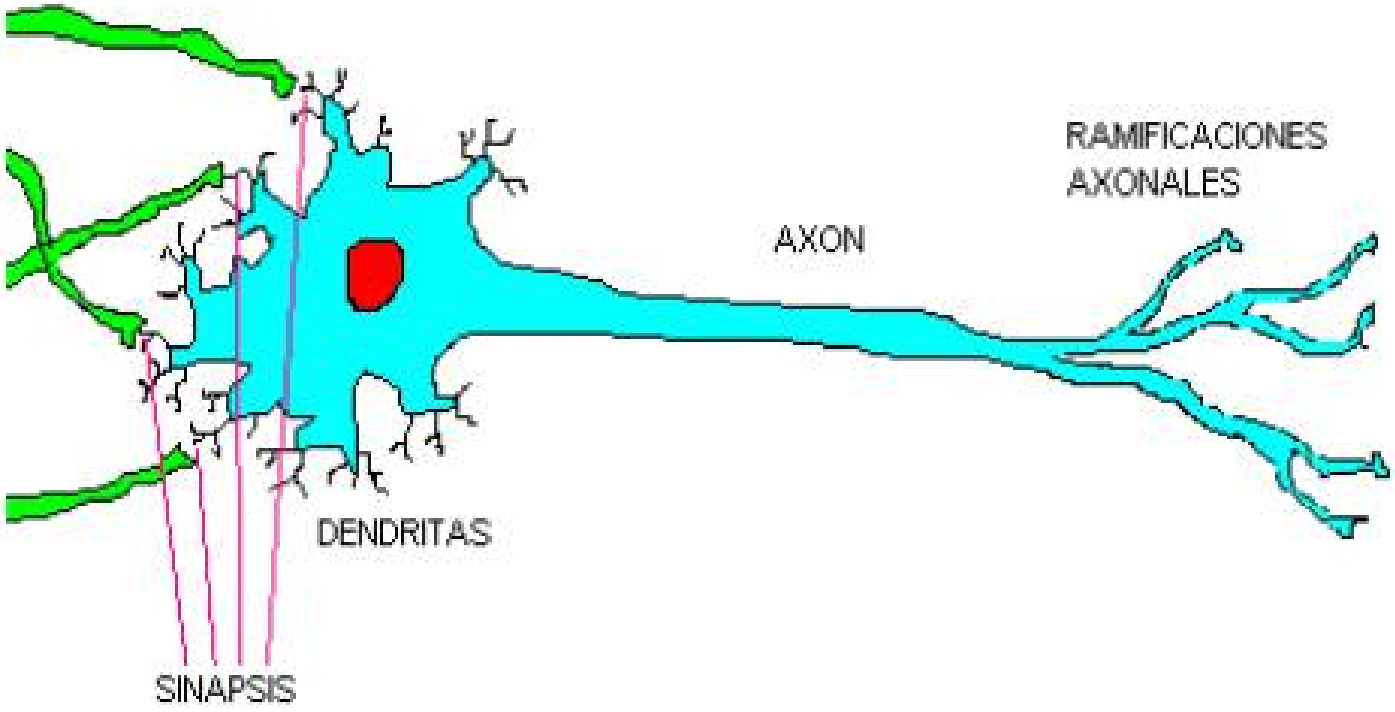
neuron collects signals from other neuro
human brain consists of mil

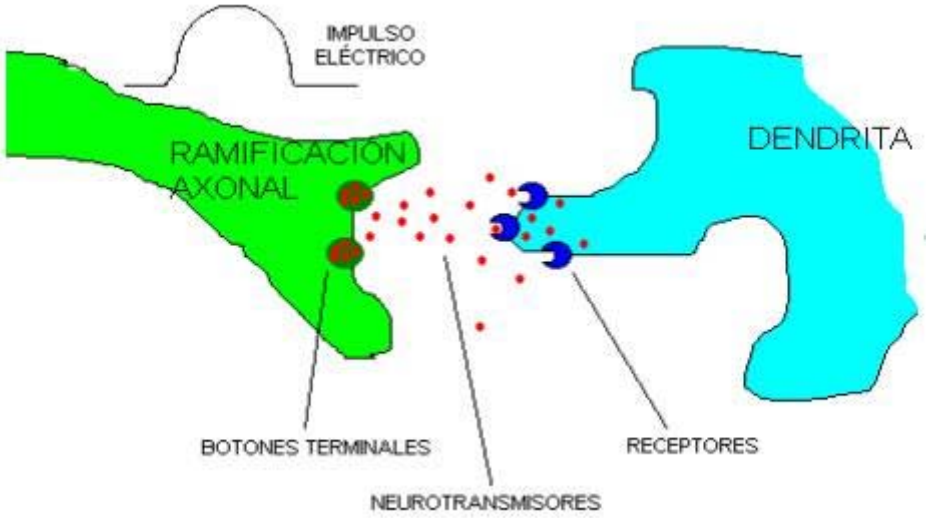
information

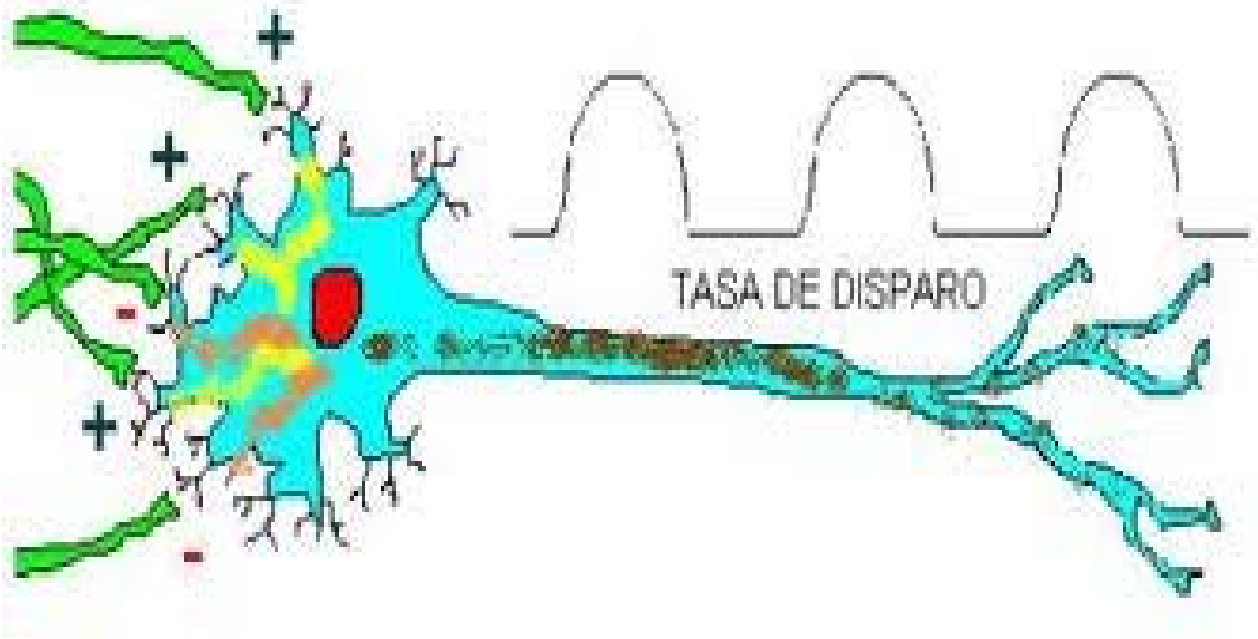
ramifications

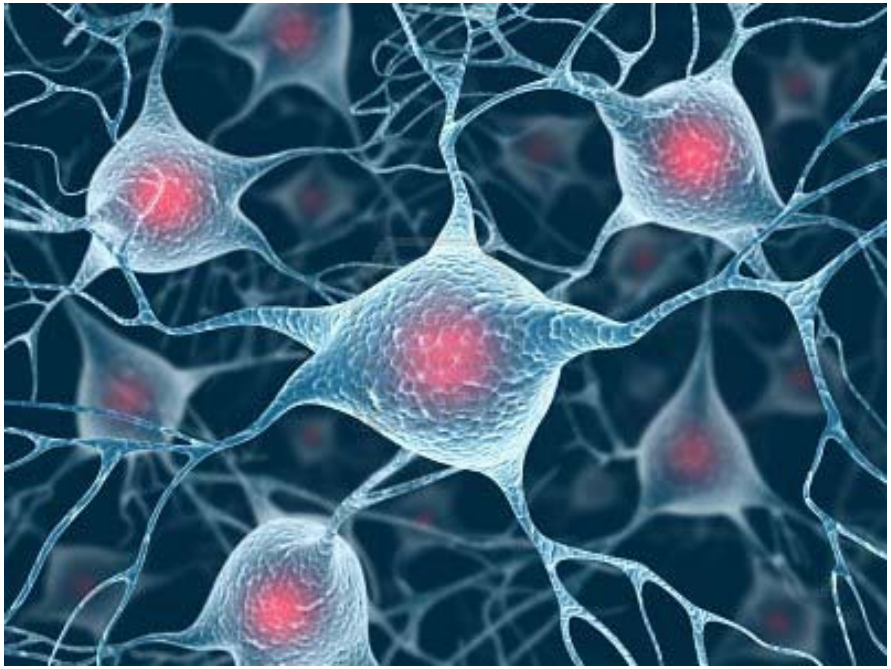
is transmitted from a neuron to another and will be pr

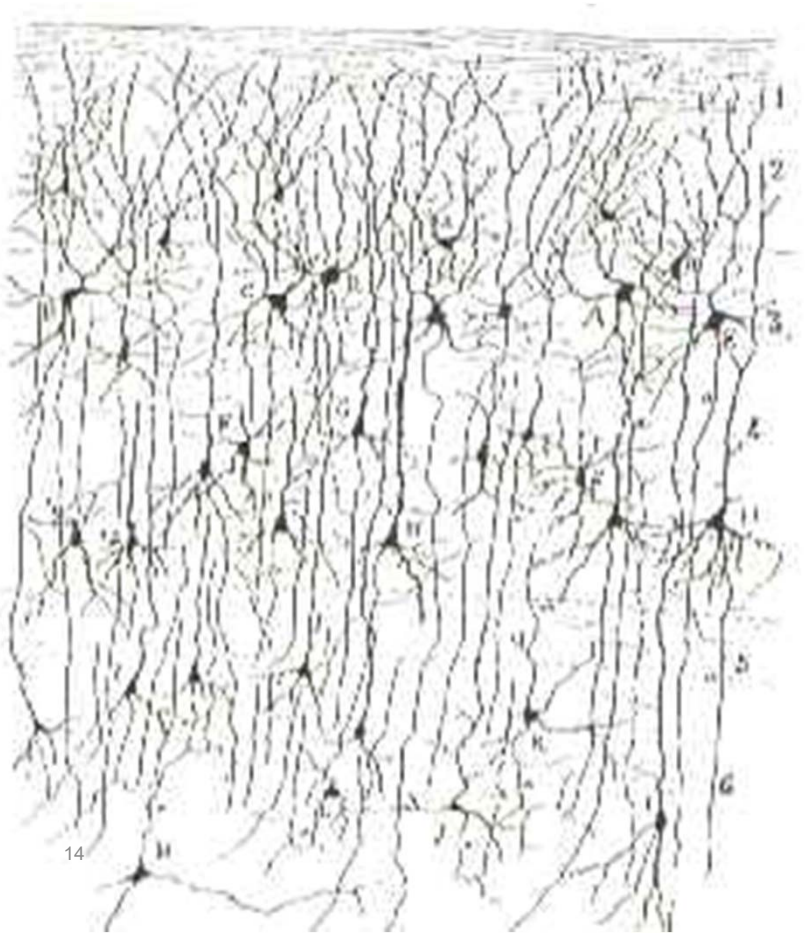
reach the dendrites of other neuron


RAMIFICACIONES
AXONALES
AXON
DENDRITAS
SINAPSIS

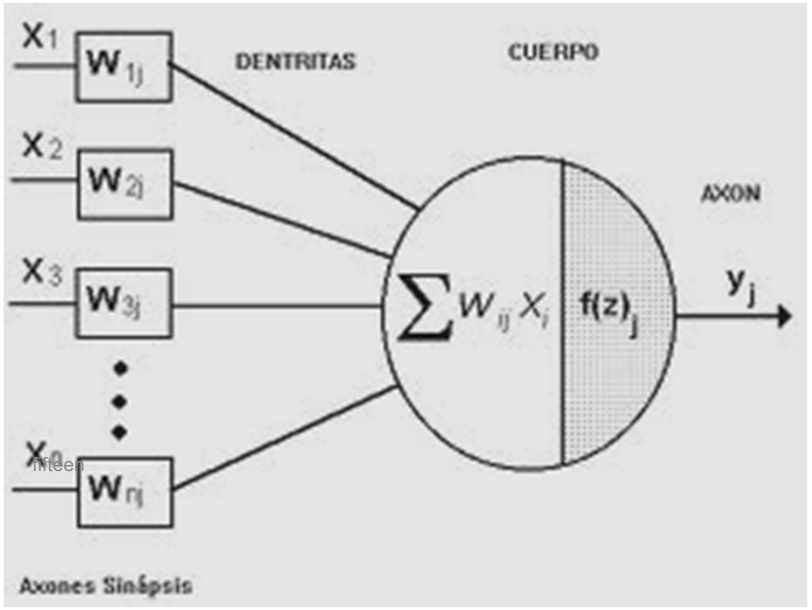

IMPULSO
ELÉCTRICO
RAMIFICACIÓN
AXONAL
DENDRITA
BOTONES TERMINALES
NEUROTRANSMISORES
RECEPTORES


+
+
-
+
-
TASA DE DISPARO





models is located on the definitio



ideas:

be

from located a active; or

Hebb set

concept

in

: the (synapses).

the

connections the from

connections be in

neurons

It represents

1949

neurons is strengthened if both are activated.

between between two

simultaneously

in fundamental

two neurons

Dartmouth IA. Here the first simul
publishes a

theory
of neural adaptation
and patterns inspired
by this theory,
Adaline (Adaptive
Linear Neuron) and
Madaline (Multiple Adaline). These models were used in numero

Perceptron, revealing serious limitations. This work created serious doub

critique of

of the

from

a serious

learning

perceptron

optical

1969)) made

identifier

results

Papert

delta,

be

1962)

they extended

to use continuous signals input and output.

published

allowed

binary

the

to

(Kohonen

trying

brain-state-in-a-box (BSB).

Sharon (Ellias,

1984) continues the work of Anderson and develops competitive

from

be based

Ritz

in

how

&

physiological

model

Jomnes

from

illustrative solves the problems posed by Minsky and Paper. In this decade, the reviva

East

group

on

highlights

the which

mechanisms algorithm

and retrieval of memory.

storage backpropagation,

remarkable

(Hinton

1986) and BAM models (Kos

are

& from

Sejnowski
is

decade

They

design a network must establish: Structure of ar

will be

units

sigmoidal activation radial

---

basis functions

organized in layers

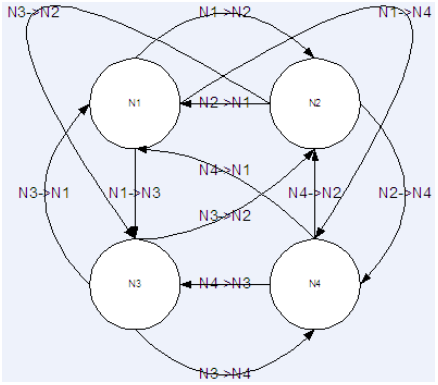
so that the output of a layer constitutes the input of th

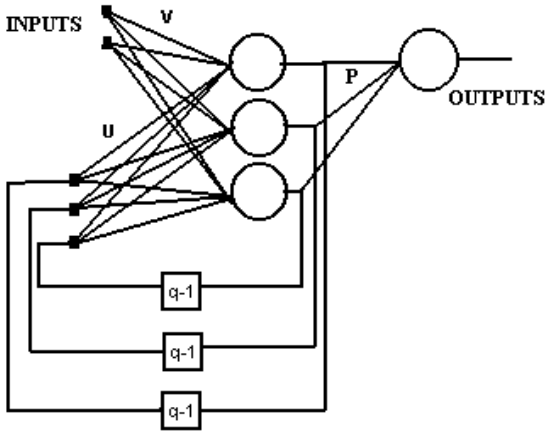
Hopfield

They have some type of feedback.

RNR ELMAN

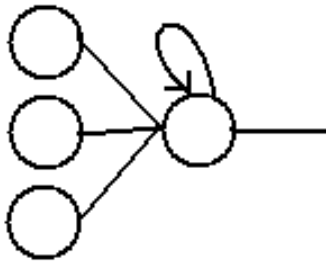
Hopfield, SOM, Elman RECURRING SECOND

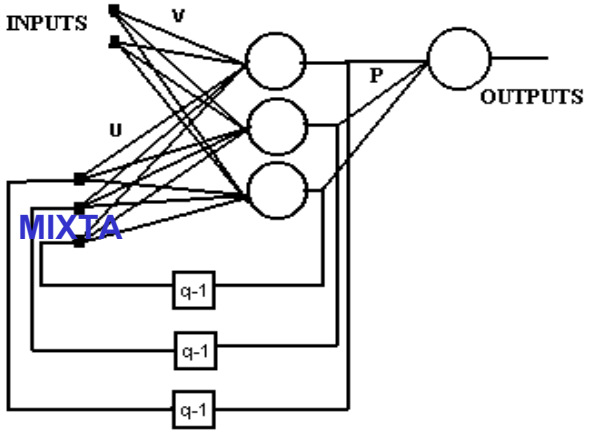


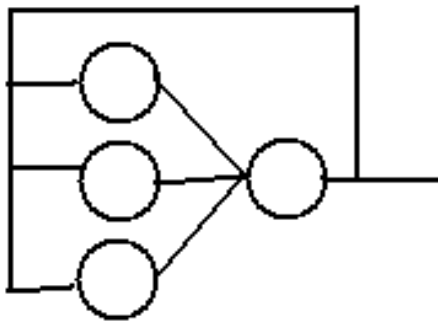


GLOBAL

Recurrence







Recurrence

Network

computing *performed*

manysimpleprocessingelementsoperatin

Study

at

(1988,

elementsornodes

parallelwhosefunctionisdeterminedby:

AFCEA

Processor

That

massivelyparallel
andmakingitavailableforuse.
you

propensityforstoringexperientialknowledge
have to

Natural

knowledge.

used

throughalearningprocess.

bythenetwork

to

store

the

They

(neurons)

are "

machines

»compuestasdegrancantidadd

Numerical

is determinadopor:

a

RNA

It

are many types of models f

for the topology there are al

Neuronas Biológicas	Neuronas Artificiales
Neuronas	Unidades de proceso
Conexiones sinápticas	Conexiones ponderadas
Efectividad de las sinápsis	Peso de las conexiones
Efecto excitatorio o inhibitorio de una conexión	Signo del peso de una conexión
Efecto combinado de las sinápsis	Función de propagación o de red
Activación -> tasa de disparo	Función de activación -> Salida

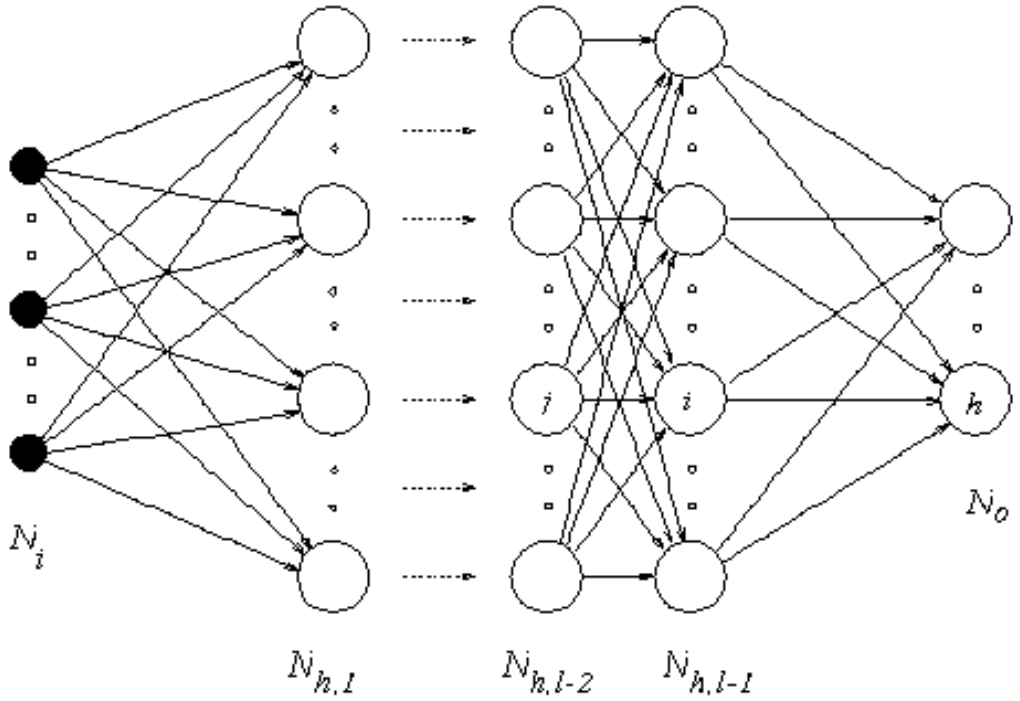
informacióncontenidaenunatabla

(X, Y) of paresdeentradasalida.

RNA

is

Multilayer


N_i
$N_{h,1}$
$N_{h,l-2}$
$N_{h,l-1}$
N_o
j
i
h

encapsulates a function

y = F (x) x ЄR ** Ni;

and ЄR ** No.

Unperceptronpuede

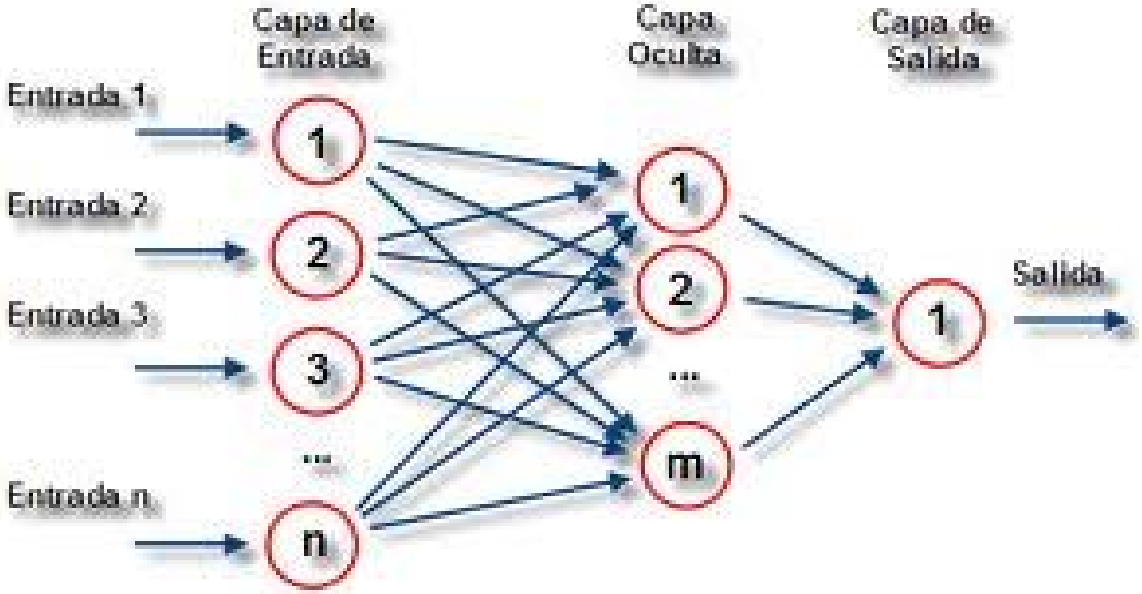
"learn", adjusting pesosdelasconexiones, cua

can "learn",

ajustandolospesosdelas

connections,

cualquierrelacióndeentradasalida y = F (x)


Capa de Entrada
Capa Oculta
Capa de Salida
Entrada 1
Entrada 2
Entrada 3
Entrada n
1
2
3
...
n
1
2
...
m
1
Salida

Parecidoalanterior

biológicadelosmodelos perotomacomopremisalapl

approaches

seintentadesarrollar modelo

lascapacidadescognitivasdeestosmod

(quéhoestalteoría

Genetic al

but

selecciónsonlosdoshechosqueprovocanelcambio

unaseriedehechosobservados / te

enlaNaturalezaylageneracióndenuevasespecies.

comounfluido,

yquelos "fluid" delosdos padressemezclabane

of / mendel.htm

was

Gregor Mendel in the mid-nineteen

relacionóambasteorías,

Flemming

demostrandoquelos

he described

genesdeMendeleranlosqueprop

chromosomes.

WatsonyCrickdescubrieron

célulasdecadaespecieviviente

quelabasemoleculardelosgenesestáenel DNA ácid

númerofijoycaracterísticodecr

deMichiganenAnnArbor,

"discovers"

lateoría

genéticadelaselecciónnaturalyconcluyeq

evolucióneraunaformadeadaptaciónmás

tituladoTeoríadesistemasadaptativo

Dentrodeestecurso,

fuedondesecrearon algoritmosgené

generation.

be

from

reproduce

evolution, there

offspring (sometimes **commutatio**

have

They

a

algorithms

genetic

They are

methods:
búsquedayoptimizaciónqueaplic
mismosmétodosdelaevolucionb
sistemáticosparalaresolu

elobjetivode

Max

F (x) x € X

paraunaciertafunciónobjetiv

•• Feature / Variable / Attribute particul

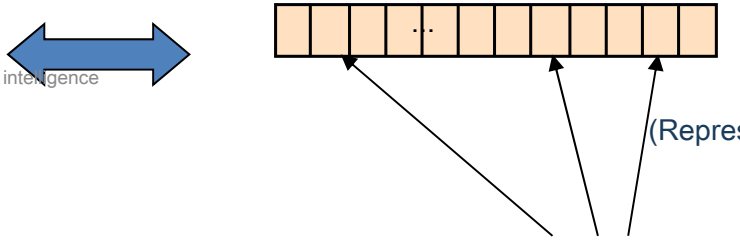
110001011101

Genes (binary coding)

Chromosome

...

...

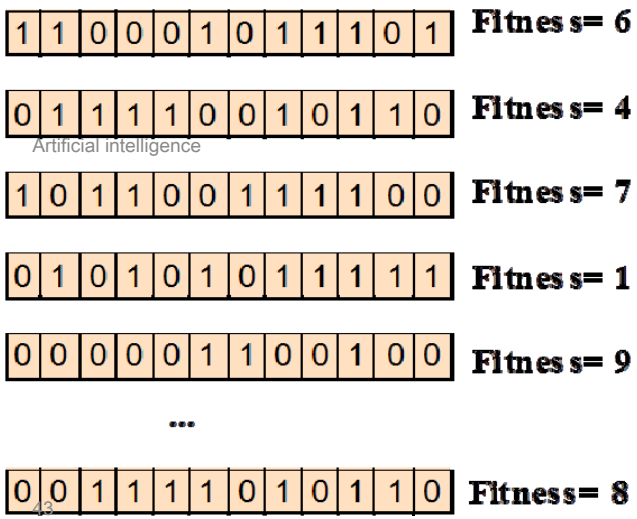


Chromosome encoding a so

(Representation of the individual)

Population

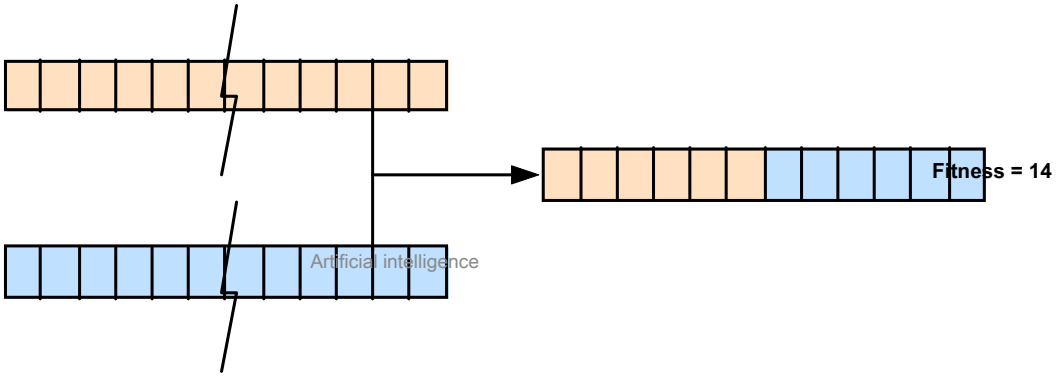
Set of solutions



Crossing. Combination of s

Fitness = 9 **Fitness = 7**

101100100100

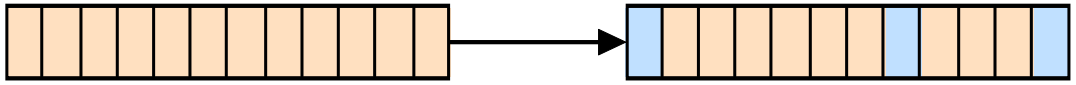


hayunaprobabilidaddadaaprioridequeun

-

Fitness 00101101

Mutación.Unoomásgenesde



individuopuedamutar.Asuvez, cuandounindividuomuta, ther

-

and

evaluate initial population

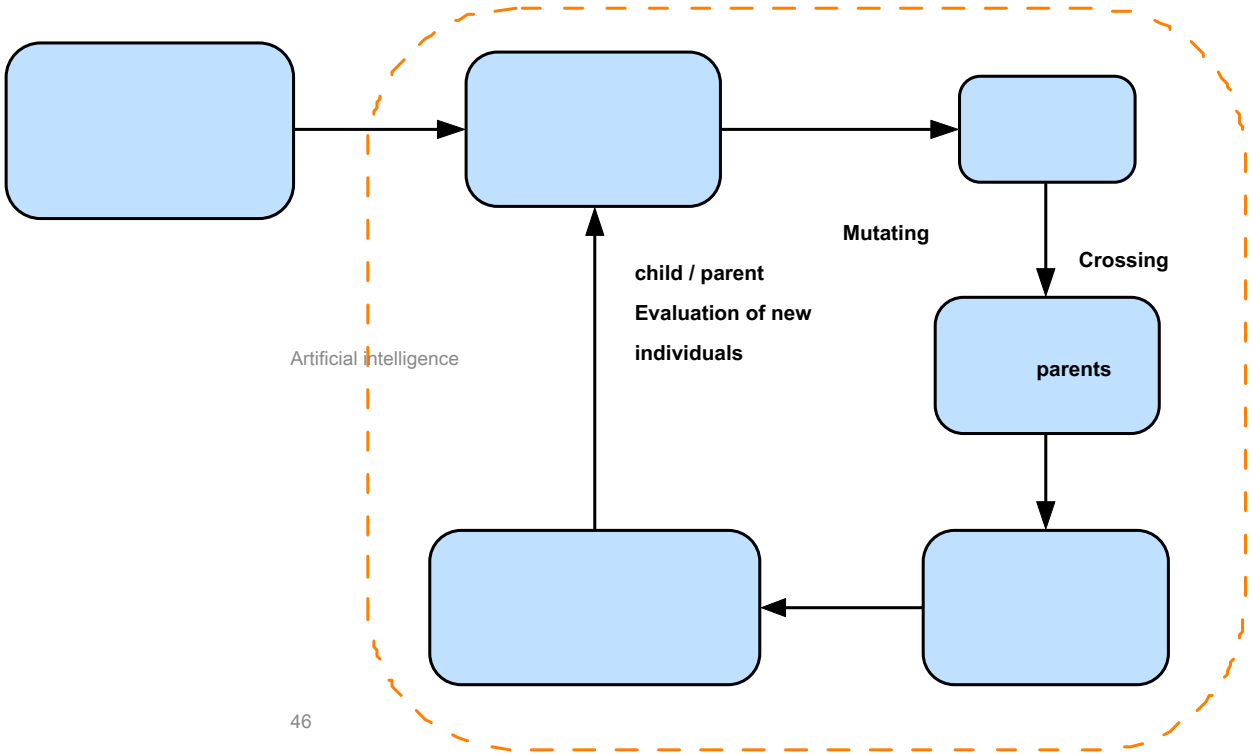
generational

Selection

of Genetic / generational process

individuals parents

replacement



perosuenciliezhacequeelalgoritmoseamasfacil decomprender.

example A

(x),

restringiendoala variablexatomarvaloresc

formade

example A

"chromosomes" lasposiblessolu

puedecodificarcon5bits (chromosome).

6individuos.

example A

tenemoscodificadalasolu

degenerarlaesaleatoriamente.

debemosescogeruntamañode

launches "chopped" in

example A

(bits) tenemosla poblacióninicial.

Artificial intelligence

cromosomasde5genes

sisalecara anotamosun0yer

6

fifty

example A

Esteprocesoseconocecomoselec

(5)

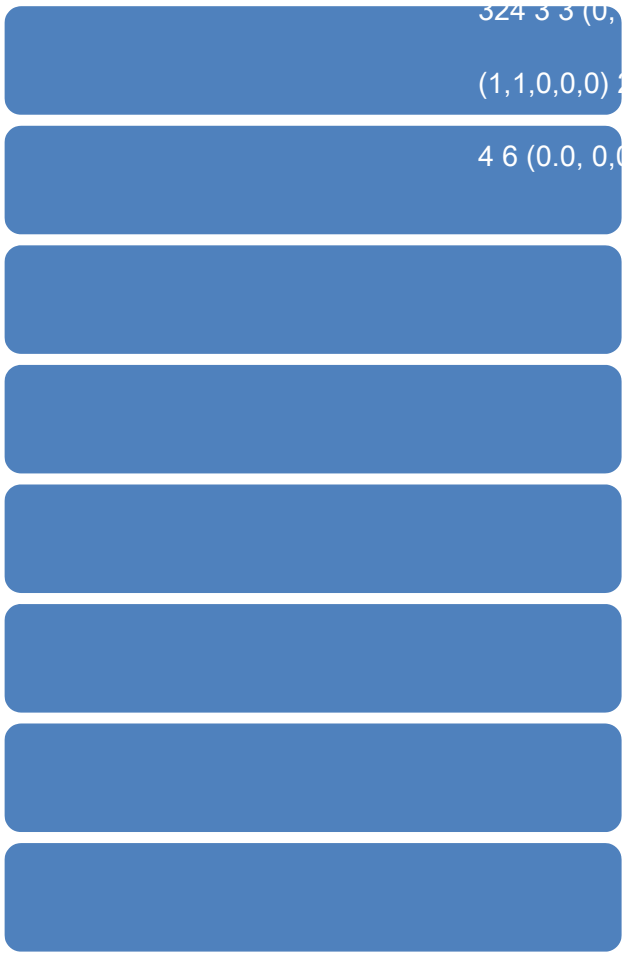
indicates

the

partner

aleatoriamenteenestecaso, acadaindividuo.
assigned,

example A



example A

is the average for this population is f me

the

l ellosharecibido

example A

poblaciónquetenemoseslamos

doscopias,

mientrasqueelsegundocaeenelolvido.

deformasimilaralaselección

example A

random

is formanparejasentrelosindividuosal

quenoesmásqueunnúmeroaleatorio entre1y4 (lalon

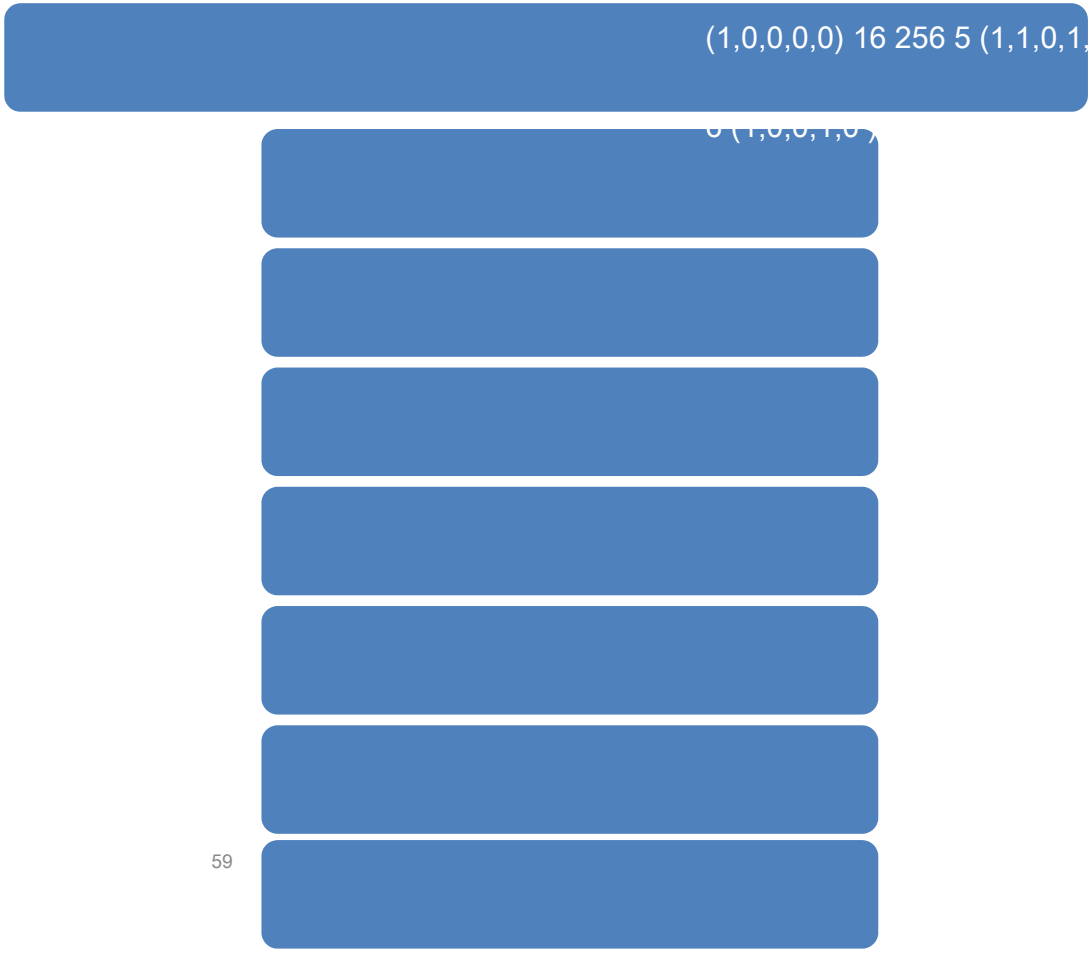
example A

example A

ylosdosúltimosdelpadre.

padreylosdosúltimosdelamadre,

example A



example A

mejoresqueantesdeestastransformaciones.

(paraelindividuo2), mientrasquear

selecciónyelcrucetomandocon

example A

inicialladelatabla3.

vecescomonúmerodeiteracionessedesee.

example A

provide to

solution.

a

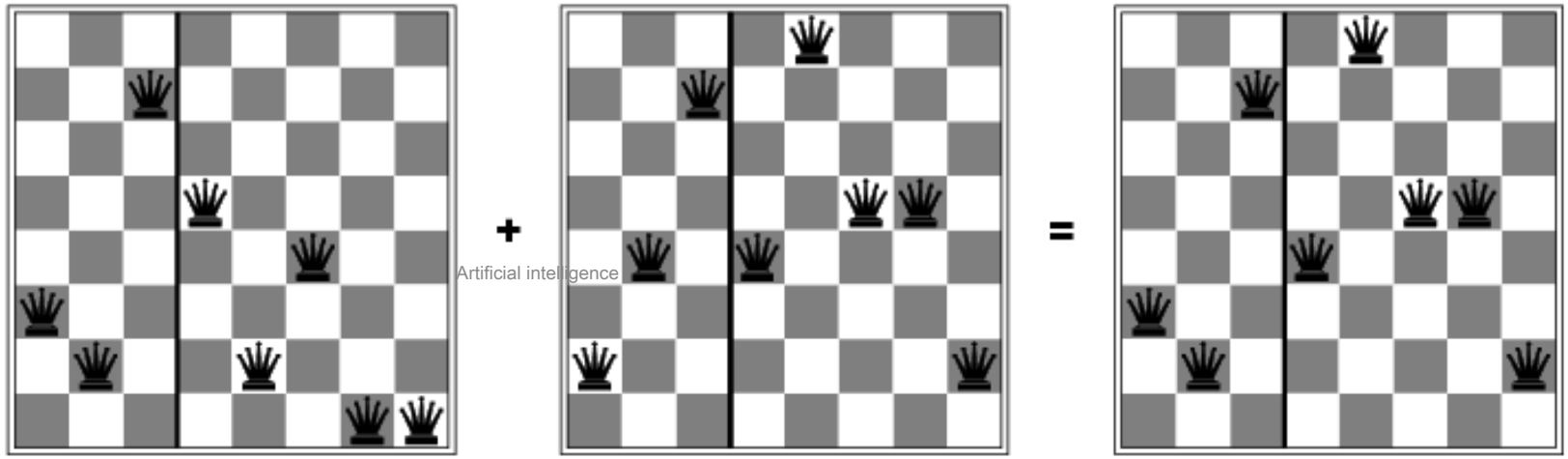
razonablementebuena

explored.

algoritmonoconfirmaquelosea.As

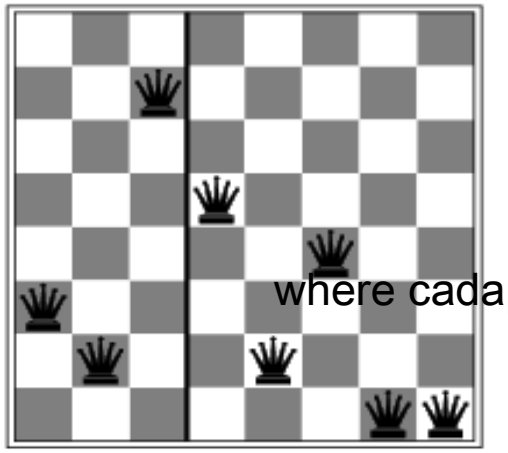
example A

aconsejablequedarseconlamejor



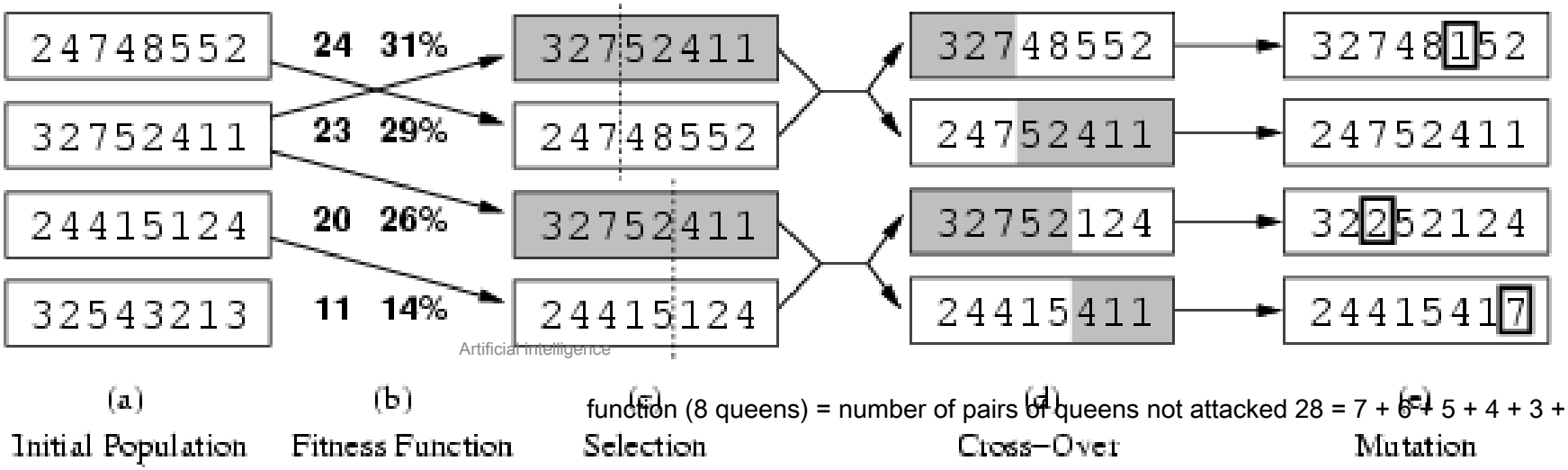
vectorde8posiciones,

numeradasde0a7



where cadaposiciónrepresentauna

Example



function (8 queens) = number of pairs of queens not attacked 28 = 7 + 6 + 5 + 4 + 3 + 2 + 1 maximum v

are many behaviors of social

of

self-organ

dynamic

mechanisms by which a system has a

changes when parameters are changed

space-time structures in a homog

(signals in the environment: stimergia)

is

fascinating

are one of the first models c

that animals almost blind, moving almost at random,

based on the

are based on the collective behavior o

moves,

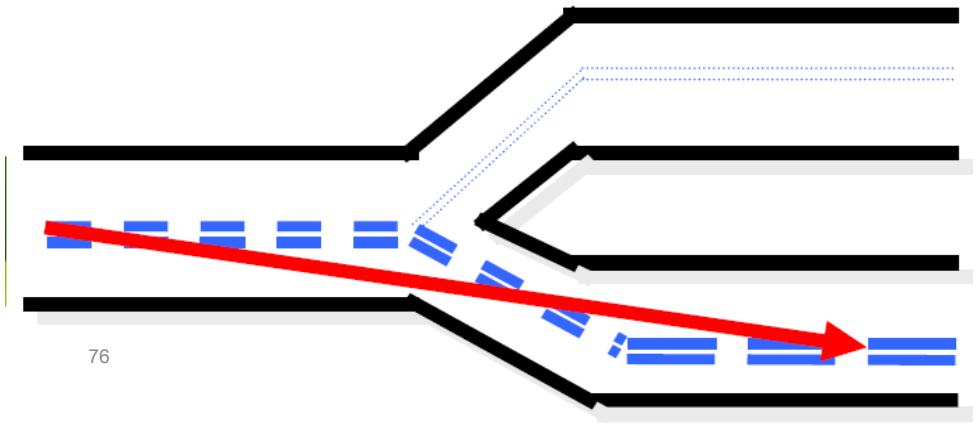
an

leaves an odoriferous signal dep

isolated ant moves essentially random, but with the

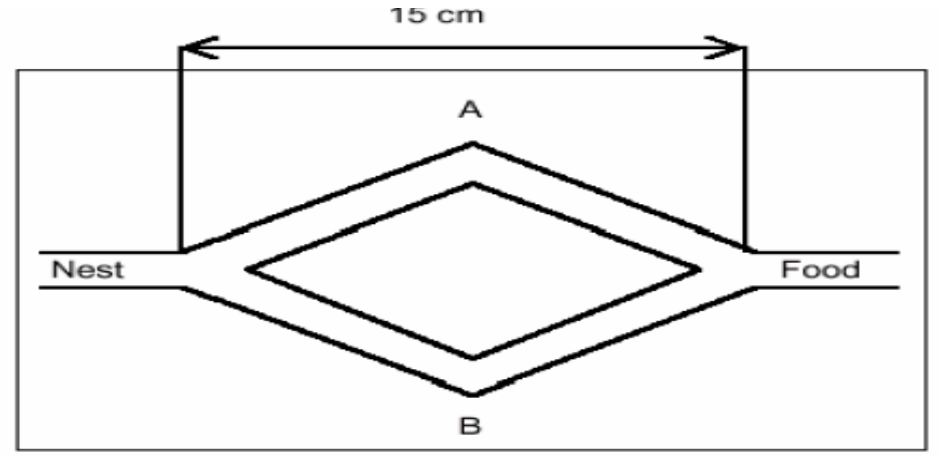
based on the

choose the czar com greater probal

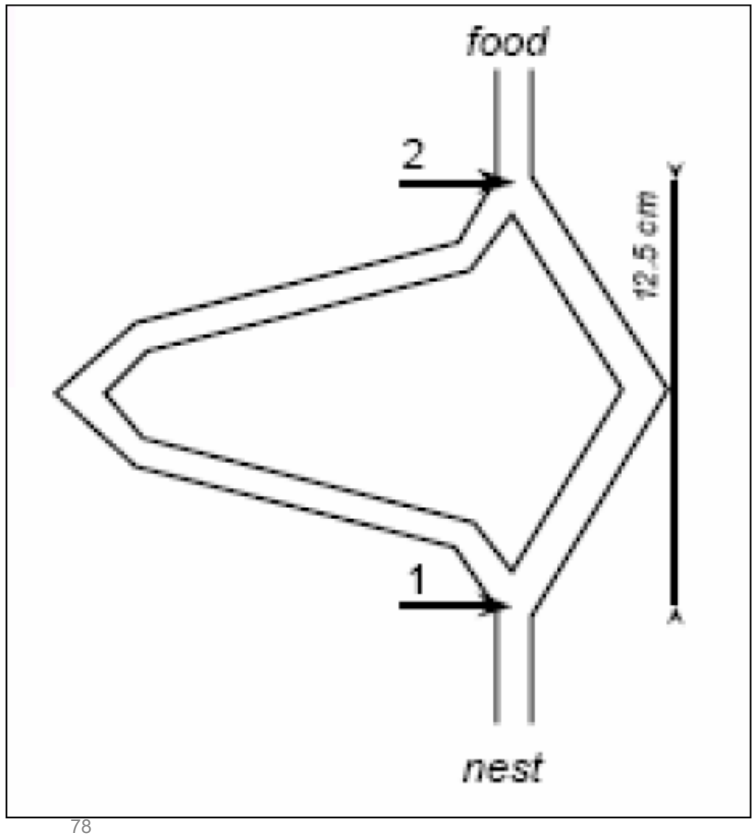


based on th

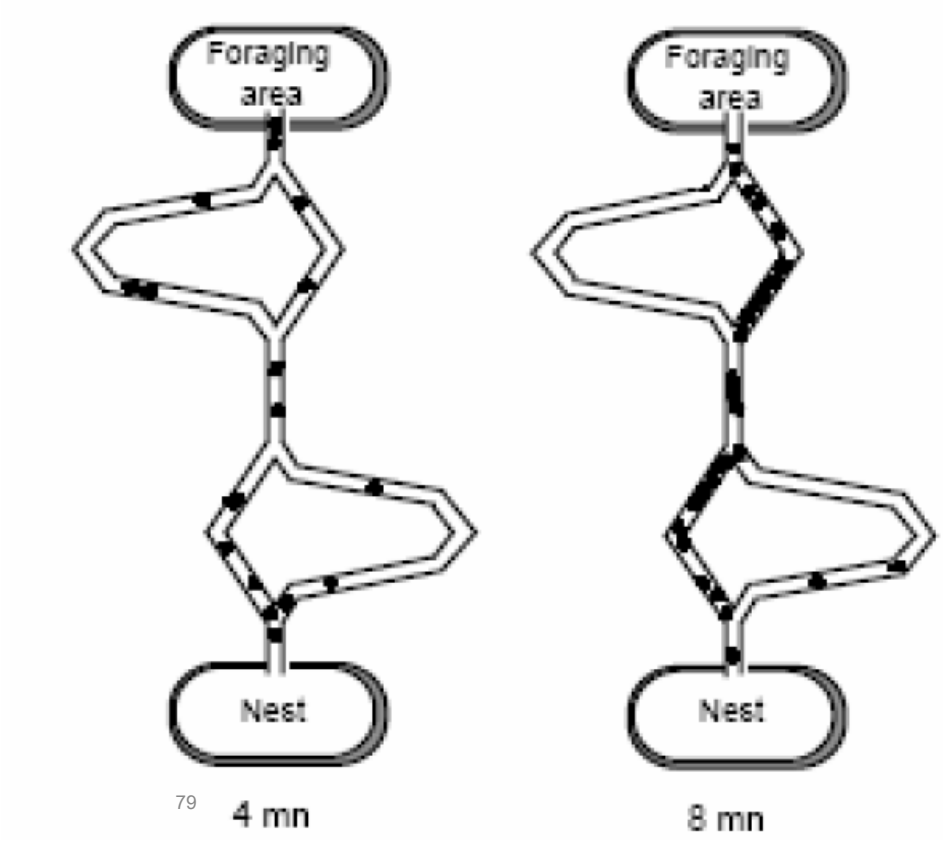
all the ants go through a branch or half one and half the



based on th



based on th



based on th

election mechanism on a fork.,

based on th

ants

puedanformularse

be

comoproblemasde

encompass caminomínimoenungrafo.

INTELIGENCIADEENJAMBRES.

in

based on th

change

of

discretely. The rule governing the transition of states in the ent

local transition rule.

*Automata, (*AC), it is a formal model com

cells, entities or *agents,*

a

elapses

instant

that time

assuming

to the

Next,

the ACs is its ability to provide

formed

to a set of rules common to all cells evolution.

may

defined

for

to be

equal for

particular instant of time.

in

set

all

a

only

finite

distributed in a n-dimensional regular

state

from

cells

cells PLC. The neighborhood influences the status change.

in

how

the

make

the

biological

the

cells

opposed

neighbors, so that an AC
a

be

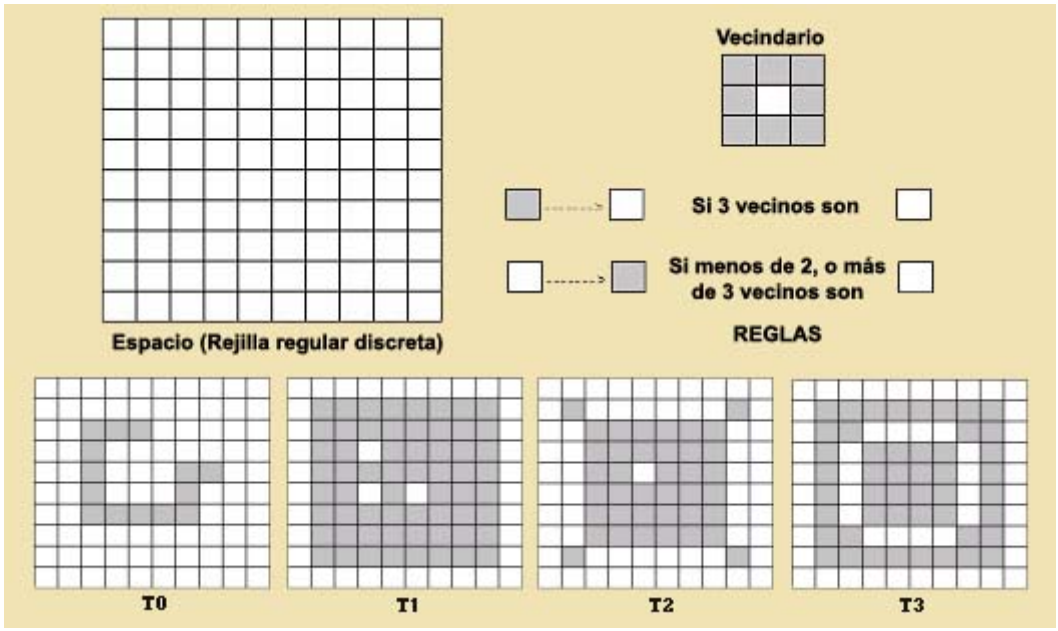
number of cells is finite, the
edges. The cells have no neighbors edges beyond the limits of the reticle.

considered

of the segment becomes a circle and a flat reticle s

of Life (**JV), devised by John Co**
where

example of the automaton defining the "Game of Li
the cells may be in a state of live (1) o



Cellular automaton "Game of Life".

Show that

from

Turing

machines

curious.

toward

the JV

from some initial configu

from

more states or

Universal

calculation

ls

equivalent

parallel

less

the

or

Cellular Automata

.

in

parallel.

Briefly,

exhaustive work of Stephen

Over the

Linear

quote

the